1. THE ISSUE

A recent paper (Haggis, 2004) argued that our understanding of student learning in higher education was limited by the dominance of psychological models of learning, evidenced in the preponderance of studies precipitated by Marton's phenomenographic findings. While such a claim may be justified, it is important to appreciate that characterisations of deep and surface learning (Marton et al, 1993) are descriptions of how students make sense of their learning, rather than explanations of learning per se. The essence of this work is that students may have very different intentions for their learning and, as a result, engage in different types of study behaviour. Without in any way demeaning the contribution of Marton and his colleagues to understandings of learning in higher education, the purpose of this article is to argue, within a psychological perspective, that it is the accounts of learning underlying such notions as deep and surface that need to be understood more rigorously because without a developed understanding, university teaching is unlikely to be compatible with any of the aims proposed for higher education such as the pursuit and transmission of knowledge or professional preparation and training (NCUP, 1996).

In the United Kingdom there is now considerable diversity in the student population (and so higher education is no longer the prerogative of a select minority but is available to many), the needs of students are more varied (thereby necessitating the promotion of different modes of study to enable students to engage in lifelong learning) and there is a rapid expansion in student numbers (thereby stimulating a need for both the employment of new staff who might not otherwise have anticipated a career in higher education and for established staff to adapt to the changing circumstances). The varying patterns of undergraduate education, the importance of the European dimension and the continuing demand by overseas students to pursue postgraduate study in the United Kingdom makes learning in higher education a live and important topic to keep under review (Tight, 2004). Given these factors, it seems important not to lose sight of the

kind of learning that universities are best placed to promote. In deliberating on accounts of learning, it is important to be clear about the unit of analysis under consideration, since educational issues can be analysed at several theoretical levels. This article is not a sustained examination of what knowledge is or where it originates or is located; which is the proper preserve of philosophy. While philosophy influences educational practice, the concerns of this article are about how a person acquires or attains knowledge. Although knowledge acquisition is one of several epistemological issues (Fitzgerald & Cunningham, 2002), it is but one part of the overriding concern of knowledge and knowing and as such affords a psychological (Hofer, 2002) as well as a philosophical analysis. In other words because the underpinning concern of this article is how students use their conceptions of knowledge and knowing to develop an understanding of the world and because the individual's acquisition of personal knowledge is the basis of learning in formal education, a psychological level of analysis is thought to have functional value in order that teachers can design and implement meaningful pedagogical practice, and that educational policy can support such an endeavour.

2. A PSYCHOLOGICAL PERSPECTIVE ON LEARNING IN HIGHER EDUCATION

The recent increased interest in learning (as evidenced in the growth of journals on the topic) suggests that learning is now beginning to be understood to be as important in higher education as it is in primary and secondary education. However, the increased interest seems not to reflect extensively the psychological perspective. While historically a psychological perspective on topics such as learning and development, individual differences, instruction, motivation and assessment was seen to contribute to the scholarly and rigorous professional knowledge of teachers (Shulman, 1990), the relevance of a psychological perspective has been questioned in the face of claims that its findings do not address the actual problems that practising teachers experience (Berlinner, 1992; Doyle, 1990). While some believe that psychology does have a contribution to make in improving educational achievement (Carroll, 1993), others question the

potential of psychology for effective educational application (Chase, 1998). Perhaps, however, the tension turns on the expectations implied by the protagonists of the alternative persuasions. The expectation that educational psychology has immediate answers to the myriad of problems that teachers face on a day-to-day basis seems rather naïve. While it may well be that teachers need knowledge that provides "quick and concrete answers to situations in which they have little time to think" (Korthagen & Kessels, 1999, p.5), such knowledge would seem to reside less in psychology and more in the literature on teaching methods. If teachers believe that they should have a repertoire of interesting activities with which to engage learners, in order that they have the "quick and concrete answers", then it is follows that it is with these activities that the teachers should acquire proficiency. But if teachers want to understand what learning is and how it takes place (in order that they themselves can determine methods of teaching), such understanding of learning rests on psychological knowledge. While it is fully acknowledged that a psychological perspective is neither exclusive nor sufficient in explaining all of student learning, it will be argued in this article that different orientations to learning have different implications for instructional practices and educational outcome which in turn may be incompatible with educational policy.

3. WHAT MIGHT BE MEANT BY LEARNING?

There is currently a powerful ideology that lifelong learning is needed in order to enable us to participate in the ever changing working environment in which we can expect to have a variety of roles. This ideology suggests that much of our learning should be practice oriented and based in real-life tasks and situations. The work-based learning (Brennan et al, 1996; Boud & Solomon, 2001) and capability movements (O'Reilly et al, 1999; Stephenson &Yorke, 1998) would be cases in point. Another would be the importance placed on field experience by professionals in training when asked to evaluate the relative contributions of 'theory' and 'practice' to their learning (Holligan, 1997). This practice-oriented perspective to learning is further buttressed by the

research evidence that points to the importance of learners being personally involved in their own learning and being motivated by being able to determine for themselves what they are to learn (Edwards et al, 1996; Sutherland, 1997). In this article there is no resistance to the view that our extant learning as experienced is important since we bring to any situation a vast array of personal theories (John, 1996; LaBoskey, 1993). However, in spite of the rhetoric to the contrary (O'Hear, 1988; The Hillgate Group, 1989; Lawlor, 1990), it is not at all clear that experience of itself does anything other than confirm our own prejudices particularly in areas in which we lack expertise (Feiman-Nemser & Buchmann, 1985). In other words, while experience may well be important it cannot be assumed that it necessarily means learning. Thus the common sense notion of learning as the all-pervasive acquisition of new behaviour and/or knowledge which is made vivid by experience (Biggs & Telfer, 1987) is an incomplete characterisation because it assumes firstly that acquisition constitutes learning without reference to transfer (Haskell, 2001); and secondly that the learning of behaviour and the learning of knowledge are indistinguishable. There is thus a need to understand learning in a much more differentiated way.

If people are to learn to reason, plan and make good decisions (which is a significant aim of higher education), they must be able to generalise what they have learned in the past to new learning and be able to apply and extend their learning to a range of situations (Haskell, 2001). Because of this need to generalise from one situation to another, the issue of transfer becomes pressing. It is suggested (Pascual-Leone and Irwin, 1994; Salomon & Perkins, 1989) that there are two ways in which this transfer occurs. One is low-road learning involving low cognitive functions and referring to concrete, experiential or infralogical learning. The other is high-road learning involving high cognitive functions and referring to abstract, conceptual or logological learning.

Low-Road Learning In low-road learning previously learned knowledge or practices can be evoked and successfully applied in a different situation. This comes about because the succession of contexts for which particular knowledge or particular practice is appropriate are closely similar but also require slight adaptation of the knowledge/practice, thereby providing sufficient opportunity to allow the flexible and repeated use of the knowledge or practices to an automatic level. Because the knowledge or practices are already developed to a level where they are both highly routinised and flexible within the individual's repertoire, they can be applied to the new situation. However, the new situation must be perceived by the individual to have characteristics sufficiently similar to those in the earlier situation(s) to trigger the apposite knowledge or practices. The critical feature of low-road learning is its automatic extension into situations that appear to be somewhat different but which can be enacted through essentially extant knowledge or practices. Salomon & Perkins (1989) illustrate low-road learning with the example of driving. Having learned to drive one car, one can extend to driving other cars and indeed to other motorised vehicles. While the initial sensation of driving the new vehicle may be a bit unsettling, one's extant driving skills only need fine tuning to accommodate to the demands of the new vehicle. Low-road learning would explain many socialisation and enculturation processes where one's behaviour might have been based on modelling or driven by reinforcement and resulted in implicit or unintentional overt performance (Salomon & Perkins, 1989). However, as Larkin (1989) lucidly points out, the frequent application of old knowledge to new situations is the popular understanding of transfer. A more elaborate understanding invokes the requirement to learn new knowledge because the context for application is sufficiently dissimilar that extant knowledge will not, of itself, suffice. This is what is meant by high-road learning.

High-Road Learning In high-road learning there is no automatic transfer of knowledge/practices from one situation to another. Rather transfer is through mindful abstraction (Salomon & Perkins, 1989). This means extracting the generic attributes from some material, situation or

behaviour, and creating a mental representation (such as a sign, a picture or a linguistic expression) of these attributes. For example, psychology students in their study of personality might notice that situational factors are a recurring theme. Having noticed that different accounts give different weightings to situational factors, the students might then be open/alert to the criterial value of the construct in their subsequent deliberations on personality. The representation is the individual's own construction and may also include other knowledge and beliefs that the individual imputes into the representation. By extracting what is understood to be central, essential or generic from the material, situation or behaviour, the individual excises memory for fine detail in order to reorganise his/her knowledge into more coarse-grained generalisations, which can therefore include more instances or examples and as a result be more powerful and economical in the thinking process. This is not to suggest that fine detail is unimportant but rather by removing the contextual specificity, the representation can have greater application to other examples. One way of thinking about the process of abstracting is to think of it as the construction of a general rule, principle or prototype that covers many instances. Although the process of abstraction is perhaps clumsy to describe, it should be thought of as something that everyone engages in regularly (Salomon & Perkins, 1989). Extracting what is central, essential or generic allows the individual to make the connection(s) between one context or situation and another; either between existing pieces of knowledge or between existing knowledge and new knowledge that is just entering the system (Hiebert, 1986). It is only when one can make the connection(s) for oneself that the individual can claim to understand. Abstractions that are given to us, foisted upon us or learned in a formulaic fashion do not constitute active learning because the distinction and relation between the rule and the instance is not understood by the individual. The importance of 'owning' one's own knowledge in this sense is what necessitates the abstraction being a mindful one. The individual must be metacognitive. In other words the individual must exercise volition, control or intention to generalise from instances and examples into the more superordinate rules or principles and then use this

abstraction in a new problem or situation. Salomon & Perkins (1989) illustrate high-road learning with the conscious decisions that we make to use particular strategies to solve new problems either because the strategies seem to pop up on relevant occasions or because we deliberately search for/retrieve previously learned strategies for potential application to the new situation. Mindful abstraction would appear to be what Bereiter & Scardamalia (1989) mean by intentional learning, which they characterise as the deliberate, conscious effort which is involved in not only completing some assigned task but also to the effort of monitoring and progressing one's own understanding of the phenomenon underpinning the assigned task. This dimension of extra effort is also apparent in Barnett's (1999) writing when he variously refers to learning as being serious, hard work, demanding, threatening or engaged responsiveness. .

The difference between low-road and high-road learning is reflected in the debate on learning from examples, as summarised by Chi & Bassok (1989) and Schmalhofer (1995). The issue turns on the extent to which working on examples that are allegedly illuminations of domain knowledge promotes learning. On the one hand examples are viewed as helpful because they require students to actively construct knowledge rather than just store it. On the other, there is the view that by concentrating on examples the student's attention is distracted from the underpinning domain knowledge. What the empirical evidence suggests is that even without domain knowledge the examples may nevertheless prove useful to students insofar as students can construct "an intermediate knowledge representation" (Schmalhofer, 1995, p.259). However, while examples are a preferred and, for beginning students, a necessary instrument for learning, empirical evidence points to students who cannot solve problems that deviate only slightly from the modelled solution, suggesting that example solutions offer only algorithmic learning (Chi & Bassok, 1989), otherwise recognised as low-level learning. But the evidence also points out that if students engage in elaborated explanations of what is happening in the example (rather than in description or paraphrasing of what the example 'says') then they have a significantly higher

chance of successful problem solving. In other words, overt explanations of their own understanding (which is trying to integrate the givens and constraints in the example with their own tacit knowledge and with new domain knowledge) reflect the students' active construction of knowledge. The requirement to incorporate appropriate but new knowledge into one's understanding is, as was argued above, the epitome of high-road learning

3. LEARNING AS THINKING AND LEARNING AS DOING

An initial attempt to delineate learning seems to suggest two essential types: behavioural learning (with exponents such as Thorndike, Pavlov, Watson, and Skinner) and conceptual learning (with exponents such as Piaget, Ausubel, Bruner, Gagne). Behavioural learning is the acquisition and application of new behaviour to result in skills and habits not previously in the individual's repertoire and would be exemplified in learning a new sequence of dance steps, learning to prepare a Bolognese sauce or learning to construct a dovetail joint. Conceptual learning is the acquisition and application of new knowledge to result in concepts and symbolic representations not previously in the individual's knowledge network and would be exemplified in learning the meaning of new ideas, making connections between two previously unrelated ideas or learning the relative merits for retailers of mail-order and supermarket shopping. In general terms, a new behaviour or skill is acquired through practice while ideas and knowledge are acquired through understanding. Another way of characterising this is as task-conscious and learning-conscious learning (Rogers 2003). In task-conscious learning the learner is usually aware of the specific task in hand but may not be conscious of learning, while in learning-conscious learning, learners are aware that the task they are engaged in entails learning. Learning itself is the task. This is not to suggest that behavioural learning and conceptual learning are mutually exclusive – many real life tasks will require both – but to suggest that any serious consideration of learning should recognise a distinction between learning that is concerned with physical, observable behaviour and learning which is concerned with the symbolic world of meanings in which people try to

construct a coherent and consistent explanation of their experiences. This latter type of learning – conceptual learning or learning through concepts – is important because of its relationship to experience, to understanding and to potential behaviour. Perhaps of even greater significance is the flexibility afforded by conceptual learning. Being able to operate with mental ideas rather than only with physical or concrete objects means we can think about not only what is happening now, but about what has happened in the past and about what might happen in the future.

Accounts of Learning: what can they offer us?

Behaviourist accounts of learning, which for many years have been very influential, essentially argue that learning is the result of the reinforcement of behaviours within a context that is deliberately manipulated by the teacher. Although a behaviourist account of learning is eschewed in this article, it is nevertheless important to be clear why it is an inadequate account for learning in higher education, given that its heuristic value, functional significance and internal consistency (to name but three scientific barometers of success) have all been very positively rated in the wider educational community of the United Kingdom. A brief résumé of behaviourist principles (Wheldall & Merrett, 1984) will remind readers, perhaps, of some of their own experiences of learning, teaching and CPD.

- Academic and social behaviour is learned. Although there is an acceptance that genetic factors determine certain behaviours, most behaviours of concern to education are learned, arguably through appropriate/inappropriate instruction.
- That behaviours can be learned also means that they can be unlearned: that is, more appropriate behaviours can replace inappropriate behaviours. The behaviourist approach to instruction proposes that any behaviour can be increased, decreased, established or maintained depending on the level of reinforcement provided.

- Learning involves change in behaviour and the purpose of instruction is to produce change in each learner's performance. Although it is acknowledged that mental processing might mediate the stimulus and response, mental processing per se cannot be admitted as proper data.
- Change in behaviour can be measured: before instruction (to establish a baseline measurement) and compared with measurement throughout and at the completion of instruction to determine gain or loss between data levels.

Behaviourist accounts thus focus on the functions of behaviour rather than the functions of the mind. The focus on what the teacher does to structure the situation, through reinforcement contingencies, implies that learning goals are set by the teacher rather than being shared or negotiated with students. There is also the implication (through the emphasis that just about any behaviour can be learned/unlearned through atomistic task analysis) that learning is the accretion of skills into increasingly more complex combinations. The role of the teacher to predict and control the behaviour of students by manipulating the environment logically prioritises as very low the opportunities for students to determine their own learning goals, to engage in effortful tasks or to assess and evaluate learning situations for themselves. If it is always the teacher who determines what is to be taught and defines and plans how the teaching is to take place then perhaps it is not surprising that students' higher order capabilities are never required, are never facilitated and do not develop.

However not only has behaviourism been dominant, it continues insidiously to be influential. A passive-reception view of learning and a naive transmission view of teaching can be evidenced in the many government driven curriculum reforms in Britain, which assume that curricular innovation and development can simply be transmitted to educationalists who will passively absorb the decreed changes and then cascade them 'further down the line'. According to Ernest

(1991), such conceptions and strategies are deeply embedded in the public consciousness. The expectations of students, politicians and the general public may then comprise a view of instruction that is inconsistent with more recent understandings of learning, thereby making the instructional task even more difficult. However, not only is behaviourism argued to be an incomplete account of learning, society's obsessive concern with accountability may well mean that the ideology of behaviourism is accepted as dominant with the language of learning outcomes, objectives and achievements increasingly distorting teaching towards assessment. This can create a gradual marginalisation of those concepts which remain unexpressed and can lead to teaching which is purportedly reformed but merely comprises practices which are grafted on to the questionable assumptions of a behaviourist account of learning, thereby losing much of their potential to facilitate the intentional learning (Bereiter & Scardamalia, 1989) which is so necessary for higher education.

Higher education has long professed the aim of encouraging autonomous learning but it has not been immune to behaviourism. Its primary pedagogic method has traditionally been one of lecturing, note-taking and memorizing information for later recognition or reproduction, and while current lecturing practices might regularly incorporate various manifestations of 'buzz groups' (Brown & Atkins, 1988) to engender cognitive engagement (Harvey & Knight, 1996), the students' preconceptions of learning may neither include nor recognise the relevance of such activities (Prosser & Trigwell, 1999) thus attenuating their pedagogic purpose. Lecturing is based on an account of teaching as predominantly telling and showing. If we want people to know what we know, we tell them and/or show them. Unsuccessful teaching tends to be remedied by repeating the curriculum content, breaking the communication into smaller parts, and finding different ways to express the idea to be grasped. The account of learning on which this traditional teaching is based is a behaviourist one that assumes knowledge to be some sort of commodity which can be passed from person to person in inert form.

Constructivism – an alternative account of learning

More recently, the education community has begun to question this traditional view of learning as increasing research has rendered explanations of thinking and knowing using only behaviourist terms to be unsatisfactory. Instead, we now understand that people learn by being involved and by being active in the learning process, often working in collaboration with others. Constructivist explanations, as distinct from behaviourist explanations, are concerned with what might be happening in the learner's head. This view of students as active constructors and organisers of their own learning is reflected in Piagetian theory where the student's construction of knowledge is a self-regulating process. Individuals' cognitive schemes allow them to establish an orderliness and predictability in their experiential worlds. When experience does not fit with the individual's schemes, a cognitive disequilibrium results, which triggers the learning process. This disequilibrium leads to adaptation (in which the individual aims to produce coherent, non contradictory structures or schemes). Reflection on successful adaptive operations (reflective abstraction) leads to new or modified concepts (accommodation), contributing to re-equilibration. Thus from a constructivist perspective, knowledge is not passively received from the world, from others, or from authoritative sources. Rather, all knowledge is created as individuals (and groups) adapt to and make sense of their experiential worlds. Further, Lave (1988), Vygotsky (1978) and others argue that the construction of knowing is not a matter of individual, solitary construction of understanding, but a dialectical process firmly grounded in a system of social relations. For them all knowledge is socially constructed, regardless of whether it is an individual's personal understanding, the very intellectual disciplines that we seek to learn, or the social organizations in which we study, work, and play. Within this perspective, the qualitative restructuring of thought is related to the acquisition and use of powerful new tools and signs for mediating thought. These tools and signs are cultural creations and help to shape the structure and organization of individual thought by emphasizing particular, socially valued relationships and processes of

reasoning. The means for intellectual change lies in the individual's appropriation and exercise of these socially constructed mediators, as the tools and signs help to organize and shape their experiences and interpretations of the world. This view of knowledge construction represents a very significant move from behaviourism in that it recognises that knowing is active and that it is based on previously constructed knowledge.

4. DIFFICULTIES FOR CONSTRUCTIVISM IN THE CURRENT CONTEXT

While constructivism has given us a fundamentally different way to think about knowledge acquisition and potentially provides powerful analytical tools to unpack the processes of learning, its application in higher education appears to be constrained by its lack of prescription of pedagogical practices. The range of instructional practices which teachers need in order to genuinely subscribe to a constructivist view of learning are not well understood (Brophy, 2002). In other words while constructivism provides an orienting perspective, may change our conception of learning, and lead us to question the adequacy of traditional models of teaching, it does not define a particular teaching practice. In addition, constructivism is diametrically opposed to some of the assumptions that appear to underpin currently dominant practices. One is the underpinning belief that there is simple and certain knowledge of which the students should be appraised either through their own or others' efforts. The view that knowledge can be handed down by authority is common amongst unsophisticated undergraduates (Hofer & Pintrich, 1997; King & Kitchener, 1994; Perry, 1970) and may even be shared by those teachers who are either of the view that students are incapable of thinking for themselves (Detterman, 1993) or of the view that active learning is limited to reasoning about personal experience. Much of the educational enterprise assumes safe and certain knowledge. Educational assessment, to take but one very significant illustration, is replete with instances: there is the heavy reliance (for arguably good reason) on learning in higher education being evidenced through summative assessment (Maclellan 2004); there is the frequently rehearsed debate on how to 'give' assessment feedback

so that students can see what they need to do to 'improve' (Freeman & Lewis, 1998; Miller et al, 1998; Sadler, 1989); and there are the contentious issues of reliability and validity in which not only is knowledge safe and certain, but it can also be ascribed coefficient values (Thorndike, 1997). The idea that there might be some received truth to be passed on as a commodity to some ignorant recipient is quite inconsistent with constructivism. Constructivism does not assume that people are like empty vessels, to be filled up. Yes, it is possible that students will have constructed knowledge other than what the teacher might consider to be useful pre-requisite knowledge for the teacher's intention, but this is not the same as saying that the student has no knowledge. Further, constructivism would posit that the knowledge that the student has already constructed must have served some purpose for the student in the past, and that it is that knowledge which should be the springboard for further deliberations.

A second assumption, evidenced in countless texts that purport to explain either course design or teaching, is that knowledge can be transmitted. For example, guidance given by Forsyth et al (1995) suggests that teachers determine whether they want to

> *pass on information, show examples or illustrations of the new information and how it works, give the learners second-hand experience by working through examples of the information in practice or place the learners in hands-on situations and require them to demonstrate their abilities with the new information (p. 27).*

Further, it is not unusual for teaching to be described in ways similar to those of Ashman & Conway (1997) who claim that the teacher's task includes the selection of content (to be determined through having a clear, unambiguous statement of the desired learning outcome either in terms of factual knowledge alone or in terms of facts plus processes) mastery of which is then modelled by the teacher and practised by the student. Because of the assumption that it is possible for one person to understand pieces of knowledge that have been constructed by another,

almost all of our educational provision is represented in terms of knowledge transmission (of what is deemed important to 'know', of how this 'knowledge' will be imparted and of how the appropriated 'knowledge' can be assessed) thereby suggesting that knowledge construction is not within a particular context, for a particular purpose or by persons who wish to resolve particular problems (Newman & Archbald, 1992). Furthermore, even if students do construct knowledge which for them is authentic, there is no assurance that what students learn corresponds to the teacher's knowledge. There is thus no mechanism within constructivism to explain how knowledge can be transmitted from one person to another, or how knowledge can be conveyed 'correctly' or even effectively (Pépin, 1998).

A third assumption, related to the previous two, is that knowledge is a commodity that is passed on to others, regardless of the others' perceptions of the appropriateness of this knowledge to enable them to solve some problem. Although the problem of inert knowledge was first recognised more than seventy years ago (Whitehead, 1929) and although there is considerable evidence that students fail to use their extant knowledge spontaneously, even when provided with cues and clues (Bransford et al, 2000), society's belief in the appropriateness of pre-determined curricula is nevertheless a dominant, if substantively contested, value (Brown, 2002; Bryce & Humes, 2003). The many and frequent references to the importance of 'teaching the basics' is testimony to this belief. Knowledge is thus seen as having helpful properties that can act in a preventative fashion (in much the same way as using contraception prevents pregnancy or medical immunisation prevents certain diseases) should particular circumstances prevail. In this fashion, knowledge is equivalent to savings in the bank for a 'rainy day'. However, as has already been stated, constructivism would claim that one only appropriates knowledge in the context of current understandings. It is only if the individual anticipates that some particular knowledge may be useful in the future, say, that it will be attended to. It is not therefore possible to construct knowledge and understanding in the present which will be of use in some future, unforeseeable

and unforeseen eventuality. As Pépin (1998) persuasively argues, education conceived of as the transmission of safe and certain knowledge, to the great unknowing, for possible use at some indeterminate time in the future cannot be mediated by constructivism.

5. IMPLICATIONS

To the extent that behaviourism and constructivism, developed at different times in history, can only be partial accounts, their limitations have to be acknowledged. However, it is the different social effects engendered by the accounts that are of interest. Because they would seem to describe learning in quite different ways, they can also provide conceptual tools for organising learning experiences in different ways. It is the nature of these learning experiences that is likely to leave learners with an overall, general, if perhaps ill defined, view of what learning means to them. Because of behaviourism's focus on environmental structures such as reinforcement contingencies and contextual manipulation, the relevant planning and organisation involved in learning a complex act has to be determined by those who structure the environment. This emphasis on extrinsic demands is manifest in the expectation that others will do the complex thinking for us and so results in a general notion of learning being what others want/require us to do. Constructivism, on the other hand, focuses on the mental functioning of persons, either collectively or individually and so the learning of a complex act is both conceived and constrained by the learners' efforts to solve problems. The planning and organisation involved in learning is a matter for the individual rather than environmental agencies and would follow the essential principle of teaching students to handle situations which they encounter when dealing with the world by using techniques which are applied by researchers. The principal role of the teacher is to guide students to the generation of hypotheses, interpretation of data, and the development of constructs which are viewed, within their own fields of study, as appropriate ways of interpreting the world. This approach focuses on the adequacy of the current paradigmatic viewpoint to demonstrate that investigations might be confirmatory, but equally,

that they may lead to the refutation of, and the suggestion of change from, the current point of view. What ever the case, the major emphasis lies not with the content but with reflective criticism of research procedures and thought processes of authorities as it is through the process of reflective criticism that the students learn the procedures and thought processes of researchers and how to improve upon them. Some readers may recognise this as a means of facilitating metacognition. Thus teachers design situations so that students are caused to employ procedures that researchers use to recognise problems, to ask questions, to apply investigational procedures, and to provide consistent descriptions, predictions, and explanations which are compatible with shared experience of the world.

Learning thus becomes a matter of developing, revising and refining the mental representations that one has for the rules and procedures for correct and efficient problem solving and has implications for both teacher and student roles. Given that there is a primary emphasis on a problem-centred approach, that the focus lies with learning and applying appropriate investigational or analytical strategies, that memorising 'facts' which may arise is not as important as developing an understanding of concepts/constructs, students' learning stems from seeking responses to questions that are directly and immediately related to their experiences and activities. Students are thus encouraged to formulate the questions which interest them such that the search for understanding of one question invariably leads to the posing of other related questions so that investigation becomes a continuing event. In this endeavour students exercise great deal of choice and share responsibility for learning. This means that questions, investigations, rate of progress and learning are all highly individualised, so it does not make sense for the teacher to have instructional lessons for the whole class nor does it make sense to use traditional assessment instruments such as examinations when more authentic assessment is called for. Key roles for the teacher include the provision of an appropriate question/framework in the absence of any student questions; a pedagogical emphasis on authentic tasks and ill-defined problems; and the

foregrounding of student responsibility to communicate their ideas to others and to defend and justify them in the face of challenge.

6. CONCLUSION

It has been argued in this article that the common sense notion of learning as the all-pervasive acquisition of new behaviour and/or knowledge, illuminated by experience, is an incomplete characterisation because it assumes firstly that acquisition constitutes learning without reference to transfer; and secondly that the learning of behaviour and the learning of knowledge are indistinguishable. Without proposing unhelpfully simple dichotomies, the evidence reviewed here suggests clearly that some types of learning (such as learning to swim, bake a cake or change a car wheel) can be better explained as changes in behaviour, and other types of learning (such as learning to read, to derive implications or to analyse text) can be better explained as changes in symbolic manipulations in the head. However, it is the latter type of learning, the learning of propositional knowledge, that is privileged in higher education (Eraut, 1994; Entwistle, 2000) because propositional knowledge provides the potential for the generation of new knowledge (Newmann & Archbald, 1992) which will be needed for solving the as yet unknown problems to be spawned in our complex, ever-changing world (Bowden & Marton, 1998). Because higher education is trying to prepare students for a future which may be very different from the present, and because the best resource we have for preparing students is our current knowledge, in its many varieties, propositional knowledge would appear to be the most potentially productive to enable students to create further knowledge as and when new problems arise. In order that students may profit from this propositional knowledge they must be required to engage in conceptual learning. This in turn has implications for the pedagogical practices that should be deployed to promote conceptual learning.

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